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The importance of assessing and communicating scientific consensus

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Abstract: The spread of influential misinformation, such as conspiracy theories about the existence of a secret, large-scale atmospheric spraying program, is contributing to the increasing politicization of science. In an important recent study, Shearer et al (2016 Environ. Res. Lett. 11 084011) employ a novel methodology to quantify the expert consensus of popular SLAP assertions. The authors find that 99% (76/77) of surveyed experts have not encountered any evidence that would support the existence of such a program. Here we argue that this finding is important because a growing body of research has shown that the public’s perception of expert consensus on key societal issues acts an important “gateway” to science acceptance. Furthermore, communicating normative agreement among experts, such as the strong scientific consensus against the existence of a SLAP, can help limit the spread of misinformation and promote more effective public decision-making about science and society.

Keywords: scientific consensus; gateway belief model; SLAP; conspiracy; misinformation.
Scientific inquiry seeks to understand, predict, and explain how our physical and social worlds work. Importantly, scientists often aspire to see the fruits of their inquiry used to benefit society. Although there are many exceptions to the rule, societal decision-makers – including public officials, business managers, civic organizations and ordinary citizens alike – are often motivated to seek out the best available scientific evidence to help inform the important decisions they must make. Cancer patients, their doctors, and health insurance companies, for example, are all motivated to know how effective various treatment options are, and for whom. Similarly, parents, school officials, and regulators are all motivated to know what levels of lead in drinking water can be considered safe for children. In turn, experts appreciate the opportunity to share what they know, so that good decisions can be made, and good outcomes are more likely to be achieved.

The ideal situation occurs when the issue at hand has been well-studied over an extend period of time and trusted science organizations have reliably concluded that the weight of evidence is unequivocal. Important current examples of issues for which a strong scientific consensus exists, include human-caused climate change (Anderegg et al 2010, Cook et al 2016), and the safety of the MMR vaccine (Taylor et al 1999, DeStefano and Thompson 2004).

A different – yet all too common – situation occurs when the weight of evidence genuinely isn’t clear, either because the evidence is limited, uncertain, or has never been quantified. This was the case, until recently, with regard to public concern about the existence of a “secret large-scale atmospheric program” (SLAP) – a concern shared by as much as 17% of the adult population in Canada, the United Kingdom, and the United States (Mercer et al 2011). This public concern arose in response to “evidence” – posted in various sites on the internet – asserting the existence of SLAP, but none of this evidence has ever been peer-reviewed by scientists.
In an important recent study, Shearer and her colleagues (2016) decided to put this evidence to a
test. They showed the evidence to 77 domain experts (i.e., atmospheric chemists with expertise
in condensation trails, and geochemists working on atmospheric deposition of dust and pollution),
and asked about each of the claims made by “SLAP theorists.” They found near-unanimous
consensus (76/77) among the experts that there is no evidence to support the existence of SLAP.
Indeed, all SLAP assertions can be explained by other factors (i.e., well known behavior of
aircraft contrails and atmospheric aerosols). This research clearly established that the weight of
evidence overwhelming disproves common “SLAP” assertions.

We contend that “scientific consensus” research of this kind is important for two key reasons; (a)
ait provides a novel methodology for assessing scientific weight of evidence, and (b) scientific
consensus highlights a special form of proof, “social proof”, that is particularly appropriate for
conveying the weight of evidence to non-scientists. Traditional scientific explanations explain
the evidence – for or against the assertion of concern – often using complicated scientific jargon
(e.g., “atmospheric concentrations per unit mass”), concepts that non-experts often have
difficulty comprehending. In contrast, scientific consensus is expressed in the form of a
descriptive norm, or the collective judgment of a group of influential individuals (experts). In
other words, consensus cues are a form of “social proof” easily comprehended by lay people and
experts alike – i.e., the proportion of relevant experts who are convinced by the evidence (e.g.,
76 out of 77, or 99%). People are generally motivated to hold accurate beliefs about the world,
and when uncertain, they often look to experts for guidance (Cialdini et al 2015). Importantly, as
a heuristic, consensus information is both accurate and appealing because it harnesses the
“wisdom-of-crowds” effect (Surowiecki 2004), which is especially strong and persuasive to people when the “crowd” consists of “wise” experts (Mannes et al 2014).

Yet, because of a well-established human information processing mechanism called the “availability bias” (Tversky and Kahneman 1971), people tend to reach conclusions – often erroneously – about the weight of evidence based on simple yet misleading information (whether deliberately misleading, or not). For example, when people see a TV news story featuring two scientists – one who is convinced of X, and one who is not – they tend to believe there is a lot of disagreement among the experts about X. Anecdotal evidence and “false media balance” have shown to undermine perceived scientific agreement (Koehler 2016). Moreover, although Shearer et al (2016) state that; “our goal is not to sway those already convinced that there is a secret, large-scale spraying program” (p.1), the propagation of conspiracy theories of this kind do in fact undermine the public’s perception of a scientific consensus (van der Linden, 2015). Therefore, in a very real sense, failure to communicate the expert consensus – when a scientific consensus exists – makes the public vulnerable to harmful misinformation (Maibach 2012).

In fact, our research, and that of several other independent research teams, has shown that this is particularly important because; a) perceived scientific agreement is a key “gateway” cognition that acts as an important determinant of public opinion and b) communicating the scientific consensus about societally contested issues – including climate change and vaccine safety – has a powerful effect on realigning public views of the issue with expert opinions (Ding et al 2011, Lewandowsky et al 2012, Hornsey et al 2016, Myers et al 2015 van der Linden et al 2014, 2015 van der Linden, Clarke and Maibach 2015). We are not suggesting that communicating scientific consensus is a magic bullet, but it is an easily conveyed fact that has shown to be broadly helpful
in reducing the “consensus gap” (Cook and Jacobs 2014), in countering motivated reasoning (Bolsen and Druckman 2015), and in safeguarding the public against influential misinformation.

In conclusion, for us, the implication of the research conducted by Shear and colleagues (2016) is that the scientific community should make an effort to put to rest the public’s erroneous concerns about the existence of a large-scale atmospheric spraying program by conveying an intuitive social fact, namely; that 99% of experts agree that there is no evidence of such a SLAP.

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References


Bolsen T and Druckman JN 2015 Counteracting the politicization of science *J. Commun.* **65** 745-69


Cook J and Jacobs P 2014 Scientists are from Mars, laypeople are from Venus: an evidence-based rationale for communicating the consensus on climate *Reports of the National Center for Science Education* **34** 3.1--3.10


Ding D, Maibach E W, Zhao X, Roser-Renouf C and Leiserowitz A 2011 Support for climate policy and societal action are linked to perceptions about scientific agreement *Nat. Clim. Chang.* **1** 462–6


Maibach E 2012 Knowing our options for setting the record straight, when doing so is particularly important. *Psychol. Sci. Public Interest* 13 105


Myers TA, Maibach E, Peters E and Leiserowitz A 2015 Simple messages help set the record straight about scientific agreement on human-caused climate change: The results of two experiments *PloS One,* 10 e0120985

Shearer C, West M, Caldeira K and Davis SJ 2016 Quantifying expert consensus against the existence of a secret, large-scale atmospheric spraying program *Environ. Res. Lett.* 11 084011


Taylor B et al 1999 Autism and measles, mumps, and rubella vaccine: No epidemiological evidence for a causal association *The Lancet,* 353 2026-29
Tversky A and Kahneman D 1973 Availability: A heuristic for judging frequency and probability *Cognitive Psychology, 5* 207-32

van der Linden SL, Leiserowitz AA, Feinberg GD and Maibach EW 2014 How to communicate the scientific consensus on climate change: Plain facts, pie charts or metaphors? *Clim. Change.* **126** 255-62

van der Linden S, Leiserowitz A A, Feinberg G D and Maibach E W 2015 The scientific consensus on climate change as a gateway belief: experimental evidence *PloS One* **10** e0118489

van der Linden S L, Clarke C E and Maibach E W 2015 Highlighting consensus among medical scientists increases public support for vaccines: Evidence from a randomized experiment *BMC Public Health* **15** 1207

van der Linden S 2015 The conspiracy-effect: Exposure to conspiracy theories (about global warming) decreases pro-social behavior and science acceptance *Pers. Individ. Dif.* **8** 171-73